FACTUAL

GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW

Lake Front

Zeolite Street NW and Bunker Lake Boulevard

Ramsey

Minnesota

NTI Project No. 18.MSP05470.000

***Prepared For**:*

Bolton & Menk, Inc.
7533 Sunwood Drive NW, Suite 206
Ramsey, Minnesota 55303

NTI
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June 27, 2018

Bolton & Menk, Inc.
7533 Sunwood Drive NW, Suite 206
Ramsey, Minnesota 55303

Attention: Mr. Kevin KP. Kielb, P.E.

Subject: Factual Geotechnical Exploration and Engineering Review
Lake Front
Ramsey, Minnesota
NTI Project No. 18.MSP05470.000

Dear Mr. Kielb,

In accordance with your request and subsequent authorization, Northern Technologies, LLC (NTI) conducted a Geotechnical Exploration for the above referenced project. Our services included advancement of nine (9) standard penetration test (SPT) soil borings, and the preparation of a factual engineering report with the results of our fieldwork. Our work was performed in general accordance with our proposal dated May 3, 2018.

Soil samples obtained at the site will be held for 60 days at which time they will be discarded. Please advise us in writing if you wish to have us retain them for a longer period. You will be assessed an additional fee if soil samples are retained beyond 60 days.

We appreciate the opportunity to have been of service on this project. If there are any questions regarding the soils explored or our review and recommendations, please contact us at your convenience at (651) 389-4203.

Northern Technologies, LLC

Morgan Bakeman, E.I.T.
Staff Engineer

Steven D. Gerber, P.E.
Senior Engineer

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a Duly Licensed Professional Engineer under the Laws of the State of Minnesota.

Steven D. Gerber
Date: 6/27/2018 Reg. No. 45298

Contents

1.0 INTRODUCTION

1.1 Site / Project Description

The proposed project consists of the utilizing the on-site materials for construction in various locations.

1.2 Scope of Services

The purpose of this factual report is to present a summary of our geotechnical exploration and provide the soil conditions encountered at the project area. Our "Scope of Services" was limited to the following:

1. Explore the project subsurface by means of nine (9) SPT soil borings. Six (6) SPT borings were advanced to depths between 23 and 30 feet and three (3) SPT borings were advanced to depths of approximately 14.5 feet existing grade.
2. Conduct laboratory test(s) on representative samples for characterizing the index and engineering properties of soils strata.
3. Provide a factual geotechnical report with the results of our field and laboratory tests.

2.0 EXPLORATION PROGRAM RESULTS

2.1 Exploration Scope

Site geotechnical exploration began on May 15, 2018, with individual SPT soil borings advanced to varying feet below existing grade at approximate locations as presented on the diagram within the appendices. Soil samples were taken at 2 ½-foot intervals to termination depth of the borings.

NTI located the borings relative to existing site features, and determined the approximate elevation of the borings using MnTOPO LiDAR maps. Boring elevations should be considered to be approximate. Please refer to the Boring/Probe Location Diagram and the Boring Logs in Appendix C.

The boreholes were backfilled with auger cuttings, or were abandoned using high solids bentonite or neat cement grout as per appropriate local and state statutes. Minor settlement of the boreholes will occur. Owner is responsible for final closure of the boreholes.

2.2 Subsurface Conditions

Please refer to the boring logs within the appendices for a detailed description and depths of stratum at the boring locations.

2.3 Groundwater Conditions

The drill crew observed the boreholes for groundwater (if any) during and at the completion of drilling activities. Table 1 details the approximate elevations where groundwater was observed.

Table 1: Apparent elevation of groundwater

Borehole	Estimated Ground Surface Elevation[1] (ft)	Boring Depth to Groundwater	Apparent Elevation of Groundwater
SB-1	867	5.5	861.5
SB-2	869	4.0	865.0
SB-3	868	5.5	862.5
SB-4	869	9.0	860.0
SB-5	871	8.0	863.0
SB-6	869	10.0	859.0
SB-7	868	10.5	857.5
SB-8	872	8.0	864.0
SB-9	871	10.5	860.5

1: Elevations were estimated using MnTopo LiDAR maps.

2.4 Laboratory Test Program

Our analysis and recommendations of this report are based upon our interpretation of the standard penetration test resistance determined while sampling soils, laboratory test results and experience with similar soils from other sites near the project. The results of such tests are summarized on the boring logs or attached laboratory test reports.

3.0 CLOSURE

As the widely spaced, small diameter borings provide only a limited amount of data regarding the existing fill, the existing fill may contain soft zones, debris or significantly greater amounts of unsuitable materials than could be reasonably inferred from the boring information. Unsuitable materials may not be discovered during construction and may remain buried within the fill below the slabs and pavements, resulting in greater than anticipated settlements of the slabs and pavements. These risks cannot be eliminated without completely removing the fill, but can be reduced by thorough exploration and testing during site preparation and construction.

The scope of services for this project does not include either specifically or by implication any environmental or biological assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of Bolton & Menk, Inc. and their agents for specific application to the proposed Lake Front project in Ramsey, Minnesota. Northern Technologies, LLC has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Northern Technologies, LLC makes no other warranty, express or implied.

Northern Technologies, LLC

Morgan Bakeman, E.I.T.
Staff Engineer

Steven D. Gerber, P.E.
Senior Engineer

APPENDIX A

GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

FIELD EXPLORATION PROCEDURES

GENERAL NOTES

WATER LEVEL SYMBOL

DESCRIPTIVE TERMINOLOGY

RELATIVE PROPORTIONS

PARTICLE SIZES

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

We visually examined recovered soil samples to estimate distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We then classified the soils according using the Unified Soil Classification System (ASTM D2488). A chart describing this classification system and general notes explaining soil sampling procedures are presented within appendices attachments.

The stratification depth lines between soil types on the logs are estimated based on the available data. In-situ, the transition between type(s) may be distinct or gradual in either the horizontal or vertical directions. The soil conditions have been established at our specific boring locations only. Variations in the soil stratigraphy may occur between and around the borings, with the nature and extent of such change not readily evident until exposed by excavation. These variations must be properly assessed when utilizing information presented on the boring logs.

We request that you, your design team or contractors contact NTI immediately if local conditions differ from those assumed by this report, as we would need to review how such changes impact our recommendations. Such contact would also allow us to revise our recommendations as necessary to account for the changed site conditions.

FIELD EXPLORATION PROCEDURES

Soil Sampling – Standard Penetration Boring:

Soil sampling was performed according to the procedures described by ASTM D-1586. Using this procedure, a 2 inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is recorded (known as the penetration resistance (i.e. “N-value”) of the soil at the point of sampling. The N-value is an index of the relative density of cohesionless soils and an approximation of the consistency of cohesive soils.

Soil Sampling – Power Auger Boring:

The boring(s) was/were advanced with a 6-inch nominal diameter continuous flight auger. As a result, samples recovered from the boring are disturbed, and our determination of the depth, extend of various stratum and layers, and relative density or consistency of the soils is approximate

Soil Classification:

Soil samples were visually and manually classified in general conformance with ASTM D-2488 as they were removed from the sampler(s). Representative fractions of soil samples were then sealed within respective containers and returned to the laboratory for further examination and verification of the field classification. In addition, select samples were submitted for laboratory tests. Individual sample information, identification of sampling methods, method of advancement of the samples and other pertinent information concerning the soil samples are presented on boring logs and related report attachments.

GENERAL NOTES

DRILLING and SAMPLING SYMBOLS		*LABORATORY TEST SYMBOLS*	
SYMBOL	**DEFINITION**	**SYMBOL**	**DEFINITION**
C.S.	Continuous Sampling	W	Moisture content-percent of dry weight
P.D.	2-3/8" Pipe Drill	D	Dry Density-pounds per cubic foot
C.O.	Cleanout Tube	LL, PL	Liquid and plastic limits determined in accordance with ASTM D 423 and D 424
3 HSA	3 ¼" I.D. Hollow Stem Auger	Q_U	Unconfined compressive strength-pounds per square foot in accordance with ASTM D 2166-66
4 FA	4" Diameter Flight Auger		
6 FA	6" Diameter Flight Auger		
2 ½ C	2 ½" Casing		
4 C	4" Casing		
D.M.	Drilling Mud	Pq	Penetrometer reading-tons/square foot
J.W.	Jet Water	S	Torvane reading-tons/square foot
H.A.	Hand Auger	G	Specific Gravity – ASTM D 854-58
NXC	Size NX Casing	SL	Shrinkage limit – ASTM 427-61
BXC	Size BX Casing	Ph	Hydrogen ion content-meter method
AXC	Size AX casing	O	Organic content-combustion method
SS	2" O.D. Split Spoon Sample	M.A.	Grain size analysis
2T	2" Thin Wall Tube Sample	C*	One dimensional consolidation
3T	3" Thin Wall Tube Sample	Q_C	Triaxial Compression
		* See attached data Sheet and/or graph	

WATER LEVEL SYMBOL

Water levels shown on the boring logs were determined at the time and under the conditions indicated. In sand, the indicated levels can be considered relatively reliable for most site conditions. In clay soils, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more pervious water bearing soil are present; and then a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed soils may not indicate the true level of the ground water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

RELATIVE DENSITY		*CONSISTENCY*	
TERM	**N_{60} Value** (corrected)	**TERM**	**N_{60} Value** (corrected)
Very Loose	0 – 4	Soft	0-4
Loose	5 – 8	Medium	5-8
Medium Dense	9 – 16	Rather Stiff	9 – 15
Dense	16 – 30	Stiff	16 – 30
Very Dense	Over 30	Very Stiff	Over 30

RELATIVE PROPORTIONS

TERMS	**RANGE**
Trace	0 – 5%
A little	5 – 15%
Some	15 – 30%

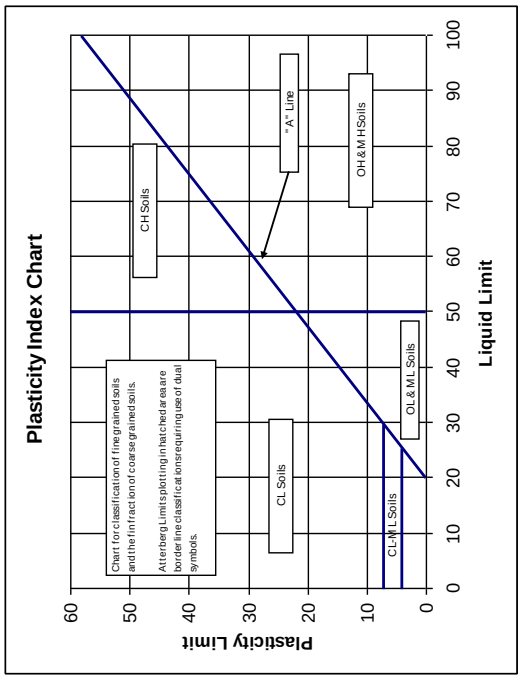
PARTICLE SIZES

MATERIAL	**DESCRIPTION**	**U.S. SIEVE SIZE**
Boulders		Over 3"
Gravel	Coarse	3" to ¾"
	Medium	¾" to #4
Sand	Coarse	#4 to #10
	Medium	#10 to #40
	Fine	#40 to #200
Silt and Clay	Determined by Hydrometer Test	

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487 and D2488 (Unified Soil Classification System)

Major Divisions			Group Symbol	Typical Name	Classification Criteria		
Course Grained Soils: More than 50% retained on No. 200 sieve *	Gravels: 50% or more of coarse fraction retained on No. 4 sieve.	Clean Gravels	GW	Well –graded gravels and gravel-sand mixtures, little or no fines.	**Classification on basis of percentage of fines.** Less than 5% passing No. 200 Sieve: GW, GP, SW, SP. More than 12% passing No. 200 Sieve: GM, GC, SM, SC. From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of duel symbols.	Cu = D60 / D10 greater than 4. Cz = (D30)2 / (D10 x D60) between 1 & 3.	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.		Not meeting both criteria for GW materials.	
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits below "A" line, or P.I. less than 4.	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.		Atterberg limits above "A" line with P.I. greater than 7.	
	Sands: More than 50% of coarse fraction passes No 4 sieve.	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines.		Cu = D60 / D10 greater than 6. Cz = (D30)2 / (D10 x D60) between 1 & 3.	
			SP	Poorly-graded sands and gravelly sands, little or no fines.		Not meeting both criteria for SW materials.	
		Sands with Fines	SM	Silty sands, sand-silt mixtures.		Atterberg limits below "A" line, or P.I. less than 4.	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits above "A" line with P.I. > 7.	
Fine Grained Soils More than 50% passes No. 200 sieve *	Silts and Clays: Liquid Limit of 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.			
			OL	Organic silts and organic silty clays of low plasticity.			
	Silts and Clays: Liquid Limit greater than 50%.		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.			
			CH	Inorganic clays of high plasticity, fat clays.			
			OH	Organic clays of medium to high plasticity.			
	Highly Organic Soils		Pt	Peat, muck and other highly organic soils.			



APPENDIX B

BORING/PROBE LOCATION DIAGRAM

SOIL BORING LOGS


Center Street NW
Bunker Lake Boulevard
Zeolite Street NW
SB-1
SB-2
SB-3
SB-4
SB-5
SB-6
SB-7
SB-8
SB-9

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BORING NUMBER SB-1

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 866.5 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 5.50 ft / Elev 861.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.5 TOPSOIL (6.0 Inches)	866.0	SS 1	89	3-3-4 (7)							
		POORLY GRADED SAND WITH SILT, (SP-SM) brown, medium to coarse grained, moist, loose, trace gravel (Glacial Outwash)		SS 2	78	2-3-3 (6)							6
		3.0 POORLY GRADED SAND WITH SILT, (SP-SM) light brown, medium to coarse grained, moist, loose to medium dense, trace gravel (Glacial Outwash)	863.5	SS 3	89	2-4-3 (7)							
5		▽		SS 4	89	3-4-4 (8)							
				SS 5	78	4-5-4 (9)							
10				SS 6	56	5-5-4 (9)							
		14.5	852.0	SS 7	89	3-4-5 (9)							

Bottom of borehole at 14.5 feet.

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BORING NUMBER SB-2

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 862 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 4.00 ft / Elev 858.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.2 TOPSOIL (2.0 Inches)	861.8	SS 1	44	3-3-4 (7)							
		1.5 POORLY GRADED SAND WITH SILT, (SP-SM) brown, medium to coarse grained, moist, loose, trace gravel (FILL)	860.5	SS 2	89	4-5-7 (12)							
		▽ POORLY GRADED SAND WITH SILT, (SP-SM) light brown, medium to coarse grained, moist, loose to medium dense, trace gravel (Glacial Outwash)		SS 3	56	4-7-7 (14)							
5				SS 4	78	3-3-3 (6)							
		NOTE: Soil gray at 8.0 feet		SS 5	89	4-4-4 (8)							
10				SS 6	100	4-5-4 (9)							
		NOTE: Soil light brown at 13.0 feet.		SS 7	89	5-5-6 (11)							
15													
		NOTE: Gravel layer at 18.0 feet. NOTE: Soil gray at 18.0 feet.		SS 8	56	5-7-7 (14)							
20													
		24.5	837.5	SS 9	67	5-5-5 (10)							

Bottom of borehole at 24.5 feet.

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BORING NUMBER SB-3

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 868 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 5.50 ft / Elev 862.50 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.3 TOPSOIL (3.0 Inches) 867.7										
		POORLY GRADED SAND WITH SILT, (SP-SM) brown, medium to coarse grained, moist, loose to medium dense, trace gravel (Glacial Outwash)	SS 1	33	4-5-5 (10)							
		NOTE: Slight iron oxide staining at 1.5 feet.	SS 2	100	5-7-7 (14)							
			SS 3	100	3-4-5 (9)							
5		▽										
			SS 4	78	3-3-3 (6)							
			SS 5	100	1-3-3 (6)							
10												
			SS 6	44	4-5-6 (11)							
			SS 7	44	4-5-7 (12)							
15												
		NOTE: Soil gray at 18.0 feet.	SS 8	56	5-6-7 (13)							
20												
25												
		27.0 841.0	SS 9	56	5-5-7 (12)							
		Bottom of borehole at 27.0 feet.										

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BORING NUMBER SB-4

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 868 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 9.00 ft / Elev 859.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.3 TOPSOIL (3.0 Inches)	867.8	SS 1	89	2-4-4 (8)							
		1.5 POORLY GRADED SAND WITH SILT, (SP-SM) dark brown, medium to coarse grained, moist, loose, trace gravel (FILL)	866.5	SS 2	100	3-4-5 (9)							
		POORLY GRADED SAND WITH SILT, (SP-SM) light brown, medium to coarse grained, moist, loose to medium dense, trace gravel (Glacial Outwash)		SS 3	100	3-4-3 (7)							
5				SS 4	100	3-3-3 (6)							
		▽		SS 5	78	3-3-5 (8)							
10		NOTE: Gray soil at 10.5 feet.		SS 6	56	3-6-5 (11)							
		NOTE: Brown soil layer at 13.0 feet.		SS 7	56	3-3-4 (7)							
15													
				SS 8	56	4-5-7 (12)							
20													
25		25.0	843.0	SS 9	78	4-5-5 (10)							

Bottom of borehole at 25.0 feet.

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BORING NUMBER SB-5

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 871.5 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 8.00 ft / Elev 863.50 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		1.0 TOPSOIL (1.0 Inches) 870.5	SS 1	78	3-3-3 (6)							
		POORLY GRADED SAND WITH SILT, (SP-SM) brown, medium to coarse grained, moist, loose to dense, trace gravel (Glacial Outwash)	SS 2	67	3-4-3 (7)							
		NOTE: Slight iron oxide staining at 3.0 feet.	SS 3	67	4-3-3 (6)							
5			SS 4	78	4-5-5 (10)							
		▽	SS 5	33	5-7-7 (14)							
10			SS 6	78	7-8-9 (17)							
			SS 7	78	6-7-8 (15)							
15		NOTE: Gravel layer at 18.0 feet.	SS 8	22	6-10-9 (19)							
20												
25		NOTE: Gray soil at 25.5 feet.	SS 9	67	7-7-10 (17)							1
		27.0 844.5 Bottom of borehole at 27.0 feet.										

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BORING NUMBER SB-6

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 871 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 10.00 ft / Elev 861.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.2 TOPSOIL (2.0 Inches) 870.8										
		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to coarse grained, moist, very loose to loose, trace gravel (FILL)	SS 1	44	1-1-1 (2)							
		NOTE: Organic soil layer at 1.5 feet.	SS 2	100	2-3-3 (6)							1
		4.5 866.5	SS 3	100	3-4-4 (8)							
5		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to coarse grained, moist, very loose to medium dense, trace gravel (Glacial Outwash)	SS 4	89	4-4-4 (8)							
		NOTE: Slight iron oxide staining at 4.5 feet.	SS 5	100	2-2-2 (4)							
10		▽	SS 6	100	4-5-5 (10)							
			SS 7	100	4-5-6 (11)							
15												
		NOTE: Soil light brown below 18.0 feet.	SS 8	56	3-4-5 (9)							
20												
			SS 9	78	4-5-5 (10)							
25												
		29.5 841.5	SS 10	67	5-5-6 (11)							

Bottom of borehole at 29.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

Inver Grove Heights
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

BORING NUMBER SB-7

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 870.5 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 10.50 ft / Elev 860.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.2 TOPSOIL (2.0 Inches) 870.3										
		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to coarse grained, moist, loose to medium dense, trace gravel (FILL)	SS 1	78	1-2-2 (4)							
			SS 2	100	5-7-7 (14)							
		4.5 866.0	SS 3	100	3-3-4 (7)							
5		POORLY GRADED SAND WITH SILT, (SP-SM) light brown, fine to coarse grained, moist, loose to dense, trace gravel (Glacial Outwash)	SS 4	100	4-5-4 (9)							1
			SS 5	100	3-4-4 (8)							
10		▽	SS 6	100	3-3-3 (6)							
			SS 7	100	4-5-7 (12)							
15												
			SS 8	78	5-7-8 (15)							
20												
		NOTE: Soil gray below 23.0 feet.	SS 9	100	7-9-11 (20)							
25												
		29.5 841.0	SS 10	100	6-7-7 (14)							

Bottom of borehole at 29.5 feet.

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BORING NUMBER SB-8

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 869 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 8.00 ft / Elev 861.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		0.9 TOPSOIL (10.0 Inches)	868.1	SS 1	89	3-4-5 (9)							
		POORLY GRADED SAND WITH SILT, (SP-SM) dark brown, fine to coarse grained, moist, trace gravel, trace organics (Fill)		SS 2	89	3-3-3 (6)							
		3.0	866.0	SS 3	78	3-4-4 (8)							3
5		POORLY GRADED SAND WITH SILT, (SP-SM) light brown, medium to coarse grained, moist, loose, trace gravel, iron oxide staining (Glacial Outwash)		SS 4	100	3-3-3 (6)							
		▽		SS 5	100	3-3-4 (7)							
10				SS 6	89	3-4-4 (8)							
		14.5	854.5	SS 7	100	2-3-4 (7)							

Bottom of borehole at 14.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

Inver Grove Heights
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

BORING NUMBER SB-9

CLIENT Bolton & Menk, Inc. **PROJECT NAME** Lake Front

PROJECT NUMBER 18.MSP.05470.000 **PROJECT LOCATION** Ramsey, MN

DATE STARTED 5/15/18 **COMPLETED** 5/15/18 **GROUND ELEVATION** 870.5 feet **HOLE SIZE** 6 1/2 in.

DRILLING CONTRACTOR NTI **GROUND WATER LEVELS:**

DRILLING METHOD 3 1/4 in H.S.A ▽ **AT TIME OF DRILLING** 10.50 ft / Elev 860.00 ft

LOGGED BY Morgan Bakeman **CHECKED BY** Steve Gerber **AT END OF DRILLING** ---

CAVE IN (ft) --- **FROST DEPTH (ft)** --- **AFTER DRILLING** ---

NOTES Elevations provided by client.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		POORLY GRADED SAND WITH SILT, (SP-SM) brown, medium to coarse grained, moist, loose, trace gravel (Fill)	SS 1	100	2-3-3 (6)							
			SS 2	100	3-3-3 (6)							
			SS 3	100	3-2-3 (5)							
4.5		866.0										
5		POORLY GRADED SAND WITH SILT, (SP-SM) light brown, medium to coarse grained, moist, loose to medium dense, trace gravel (Glacial Outwash)	SS 4	89	3-4-4 (8)							
			SS 5	100	3-2-3 (5)							
10		▽ NOTE: Soil coarse grained at 11.0 feet.	SS 6	100	3-4-4 (8)							
			SS 7	89	4-5-5 (10)							7
14.5		856.0										

Bottom of borehole at 14.5 feet.

LEGEND

SOIL BORING TO ELEVATION 840

SOIL BORING 14.5' DEPTH

TOTAL DEPTH = 203.5' (9 BORINGS)

ZEOLITE STREET NW

BUNKER LAKE BOULEVARD

RAMSEY PARKWAY

YOLITE STREET NW

CENTER STREET NW

SB 1 (448949.3922, 173654.6629)
DEPTH = 14.5'

SB 2 (449095.6128, 173865.4412)
DEPTH = 23'

SB 3 (449194.3152, 173551.3984)
DEPTH = 26'

SB 4 (449583.1433, 173699.7979)
DEPTH = 25'

SB 5 (449426.7864, 173285.3400)
DEPTH = 26'

SB 6 (449740.0574, 173231.0245)
DEPTH = 30'

SB 7 (449775.4894, 173452.6973)
DEPTH = 30'

SB 8 (450019.4373, 173169.7307)
DEPTH = 14.5'

SB 9 (449827.2039, 173071.0393)
DEPTH = 14.5'

861 POND
C-222,700 CY

842
850
860
866
868
870
872
874
876
878

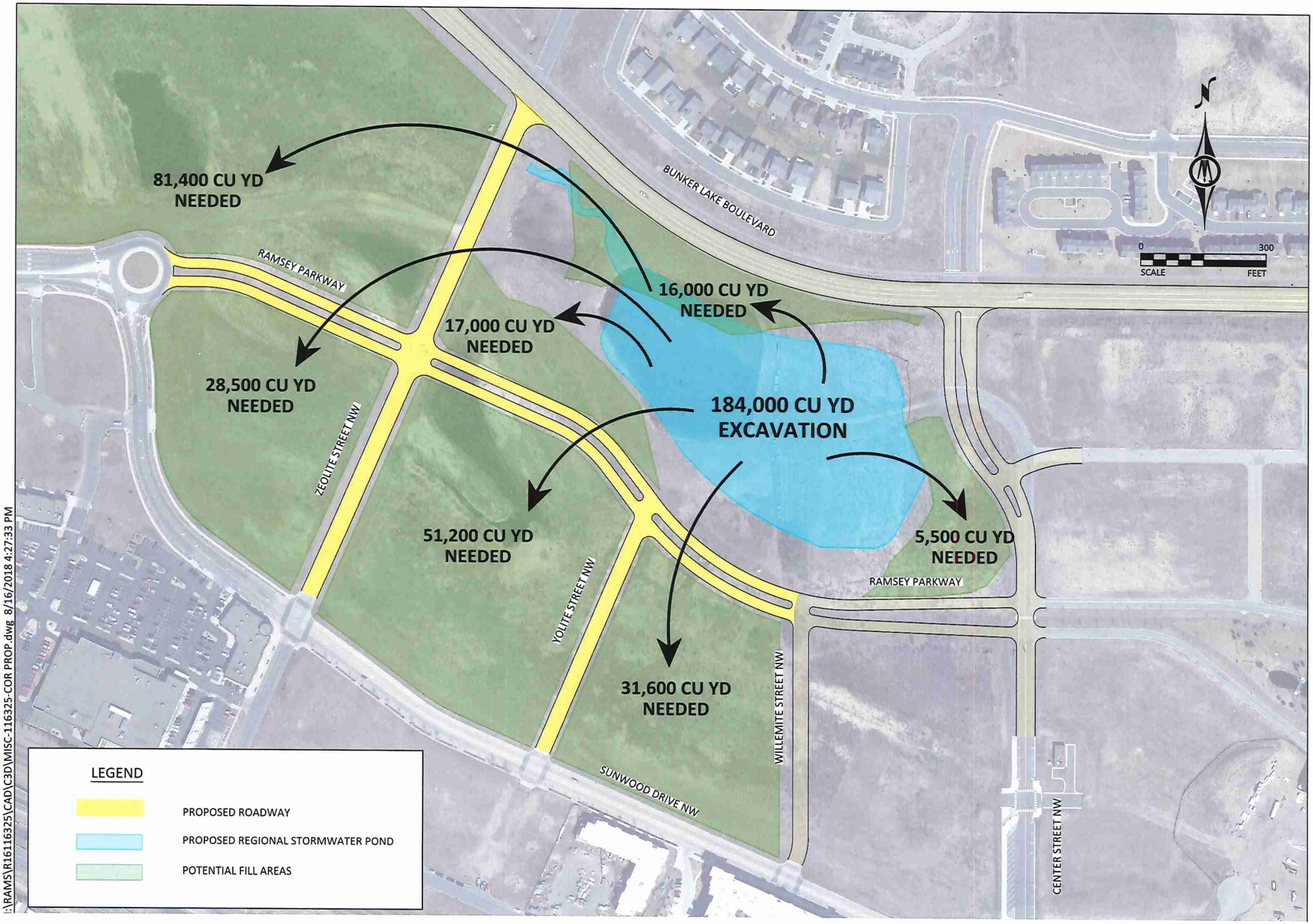
COR AREA DEVELOPMENT - POND EXCAVATION

CITY OF RAMSEY, MINNESOTA

Figure 3

AUGUST 2018

BOLTON & MENK



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